

1           What is claimed is:

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3           1.     A method of detecting edges in a compressed video sequence, the  
4     compressed video sequence including at least one frame of block encoded video data, the  
5     frame of block encoded video data including variable-length codes for transform  
6     coefficients of blocks of pixels in the compressed video sequence, the transform  
7     coefficients including a respective DC coefficient for each of the blocks of pixels, each  
8     respective DC coefficient for at least some of the blocks of pixels being encoded as a  
9     respective variable-length code having a length indicating a certain range of differences  
10    in DC coefficient values between adjacent ones of the blocks of pixels, wherein the  
11    method comprises:

12           decoding only the length of the respective variable-length code for the respective  
13    DC coefficient for each of said at least some of the blocks of pixels in order to produce an  
14    indication of whether or not the compressed video sequence includes an edge associated  
15    with said each of said at least some of the blocks of pixels; and

16           performing a code length threshold comparison upon the length of the respective  
17    variable-length code for the respective DC coefficient for said each of said at least some  
18    of the blocks of pixels for producing at least one respective bit indicating whether or not  
19    the compressed video sequence includes an edge associated with said each of said at least  
20    some of the blocks of pixels.

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22           2.     The method as claimed in claim 1, wherein the compressed video  
23    sequence is a color video sequence and there is a respective DC luminance coefficient or

1 a respective DC  $C_b$  chrominance coefficient or a respective DC  $C_r$  chrominance  
2 coefficient for each of the blocks of pixels depending on a color channel of each of the  
3 blocks of pixels, and the method includes:

4 decoding the length of the respective variable-length code for the respective DC  
5 luminance coefficient or DC  $C_b$  chrominance coefficient or DC  $C_r$  chrominance  
6 coefficient of said each of said at least some of the blocks of pixels; and

7 comparing the decoded length of the respective variable-length code for the  
8 respective DC luminance coefficient or DC  $C_b$  chrominance coefficient or DC  $C_r$   
9 chrominance coefficient of said each of said at least some of the blocks of pixels to at  
10 least one length threshold to produce at least one respective bit indicating whether or not  
11 the compressed video sequence includes a luminance edge or a  $C_b$  chrominance edge or a  
12  $C_r$  chrominance edge associated with said each of said at least some of the blocks of  
13 pixels.

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15 3. The method as claimed in claim 1, wherein the compressed video  
16 sequence is a color video sequence and there is a respective DC luminance coefficient or  
17 a respective DC  $C_b$  chrominance coefficient or a respective DC  $C_r$  chrominance  
18 coefficient for each of the blocks of pixels depending on a color channel of each of the  
19 blocks of pixels, and the method includes:

20 decoding the length of the respective variable-length code for the respective DC  
21 luminance coefficient of said each of said at least some of the blocks of pixels;

22 decoding the length of the respective variable-length code for the respective DC  
23  $C_b$  chrominance coefficient of said each of said at least some of the blocks of pixels;

1            decoding the length of the respective variable-length code for the respective DC  
2     $C_r$  chrominance coefficient of said each of said at least some of the blocks of pixels;  
3            combining the length of the respective variable-length code for the respective DC  
4    luminance coefficient of said each of said at least some of the blocks of pixels with the  
5    lengths of the respective variable-length codes for the respective DC  $C_b$  and  $C_r$   
6    chrominance coefficients of said each of said at least some of the blocks of pixels to  
7    produce a combined code length; and  
8            wherein at least one code length threshold is compared to the combined code  
9    length for producing at least one respective bit indicating whether or not the compressed  
10   video sequence includes an edge associated with said each of said at least some of the  
11   blocks of pixels.

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13           4.     The method as claimed in claim 3, wherein the combined code length is  
14   produced by adding the length of the respective variable-length code for the respective  
15   DC luminance coefficient of said each of said at least some of the blocks of pixels to the  
16   sum of the lengths of the respective variable-length codes for the respective DC  $C_b$  and  $C_r$   
17   chrominance coefficients of said each of said at least some of the blocks of pixels.

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19           5.     The method as claimed in claim 1, which includes using a thinning filter  
20   for filtering the respective bits indicating whether or not the compressed video sequence  
21   includes an edge associated with each of said at least some of the blocks of pixels.

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1           6.     The method as claimed in claim 5, wherein the filtering of the respective  
2 bits indicating whether or not the compressed video sequence includes an edge associated  
3 with said each of said at least some of the blocks of pixels includes comparing the lengths  
4 of the respective variable-length codes of the DC coefficients for adjacent blocks of  
5 pixels in order to retain indications of edges associated with blocks of pixels having  
6 longer variable-length codes for their respective DC coefficients and to exclude  
7 indications of edges associated with blocks of pixels having shorter variable-length codes  
8 for their respective DC coefficients.

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10           7.     The method as claimed in claim 6, wherein an indication of an edge  
11 associated with a block of pixels having a shorter variable-length code of the respective  
12 DC coefficients for a pair of adjacent blocks of pixels is not excluded upon comparing  
13 signs of the respective DC coefficients for the pair of adjacent blocks of pixels and  
14 finding that the signs are different.

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16           8.     The method as claimed in claim 1, which includes inspecting signs of the  
17 respective DC coefficients for said at least some of the blocks of pixels, and based on the  
18 signs of the respective DC coefficients for said at least some of the blocks of pixels and  
19 based on prediction directions of the respective DC coefficients for said at least some of  
20 the blocks of pixels and based on the respective bits indicating whether or not the  
21 compressed video sequence includes an edge associated with said at least some of the  
22 blocks of pixels, producing a first series of bits indicating whether or not the compressed  
23 video sequence includes positive horizontal gradient component edges associated with

1 said at least some of the blocks of pixels, and producing a second series of bits indicating  
2 whether or not the compressed video sequence includes negative horizontal gradient  
3 component edges associated with said at least some of the blocks of pixels.

4  
5 9. The method as claimed in claim 1, which includes inspecting signs of the  
6 respective DC coefficients for said at least some of the blocks of pixels, and based on the  
7 signs of the respective DC coefficients for said at least some of the blocks of pixels and  
8 based on prediction directions of the respective DC coefficients for said at least some of  
9 the blocks of pixels and based on the respective bits indicating whether or not the  
10 compressed video sequence includes an edge associated with said at least some of the  
11 blocks of pixels, producing a first series of bits indicating whether or not the compressed  
12 video sequence includes positive vertical gradient component edges associated with said  
13 at least some of the blocks of pixels, and producing a second series of bits indicating  
14 whether or not the compressed video sequence includes negative vertical gradient  
15 component edges associated with said at least some of the blocks of pixels.

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17 10. The method as claimed in claim 1, wherein the transform coefficients  
18 include respective horizontal frequency transform coefficients and respective vertical  
19 frequency transform coefficients for each block of pixels, and the method includes  
20 inspecting a lowest nonzero horizontal frequency transform coefficient and a lowest  
21 nonzero vertical frequency transform coefficient for at least one of the blocks of pixels to  
22 determine orientation of an edge associated with said at least one of the blocks of pixels.

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1           11.    The method as claimed in claim 1, wherein the transform coefficients  
2   include respective horizontal frequency transform coefficients and respective vertical  
3   frequency transform coefficients for each block of pixels, and the method includes using  
4   a lowest nonzero horizontal frequency transform coefficient and a lowest nonzero vertical  
5   frequency transform coefficient for at least one of the blocks of pixels for computing an  
6   approximate gradient vector of an edge associated with said at least one of the blocks of  
7   pixels.

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9           12.    A method of detecting edges in a compressed video sequence, the  
10   compressed video sequence including at least one I-frame of MPEG video data, the I-  
11   frame of MPEG video data including variable-length codes for DCT coefficients of 8x8  
12   pixel blocks in the compressed video sequence, the DCT coefficients including a  
13   respective DC coefficient for each of the 8x8 pixel blocks, each respective DC coefficient  
14   for at least some of the 8x8 pixel blocks being encoded as a respective variable-length  
15   code having a length indicating a certain range of differences in DC coefficient values  
16   between adjacent ones of the 8x8 pixel blocks, wherein the method comprises:

17           decoding only the length of the respective variable-length code for the respective  
18   DC coefficient for each of said at least some of the 8x8 pixel blocks in order to produce  
19   an indication of whether or not the compressed video sequence includes an edge  
20   associated with said each of said at least some of the 8x8 pixel blocks; and

21           performing a code length threshold comparison upon the length of the respective  
22   variable-length code for the respective DC coefficient for said each of said at least some  
23   of the 8x8 pixel blocks for producing at least one respective bit indicating whether or not

1 the compressed video sequence includes an edge associated with said each of said at least  
2 some of the 8x8 pixel blocks.

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4 13. The method as claimed in claim 12, wherein the compressed video  
5 sequence is a color video sequence and there is a respective DC luminance coefficient or  
6 a respective DC  $C_b$  chrominance coefficient or a respective DC  $C_r$  chrominance  
7 coefficient for each of the 8x8 pixel blocks depending on a color channel of each of the  
8 8x8 pixel blocks, and the method includes:

9 decoding the length of the respective variable-length code for the respective DC  
10 luminance coefficient or DC  $C_b$  chrominance coefficient or DC  $C_r$  chrominance  
11 coefficient of said each of said at least some of the 8x8 pixel blocks; and

12 comparing the decoded length of the respective variable-length code for the  
13 respective DC luminance coefficient or DC  $C_b$  chrominance coefficient or DC  $C_r$   
14 chrominance coefficient of said each of said at least some 8x8 pixel blocks to at least one  
15 length threshold to produce at least one respective bit indicating whether or not the  
16 compressed video sequence includes a luminance edge or a  $C_b$  chrominance edge or a  $C_r$   
17 chrominance edge associated with said each of said at least some of the 8x8 pixel blocks.

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19 14. The method as claimed in claim 12, wherein the compressed video  
20 sequence is a color video sequence and there is a respective DC luminance coefficient or  
21 a respective DC  $C_b$  chrominance coefficient or a respective DC  $C_r$  chrominance  
22 coefficient for each of the 8x8 pixel blocks depending on a color channel of each of the  
23 8x8 pixel blocks, and the method includes:

1            decoding the length of the respective variable-length code for the respective DC  
2    luminance coefficient of said each of said at least some of the 8x8 pixel blocks;  
3            decoding the length of the respective variable-length code for the respective DC  
4     $C_b$  chrominance coefficient of said each of said at least some of the 8x8 pixel blocks;  
5            decoding the length of the respective variable-length code for the respective DC  
6     $C_r$  chrominance coefficient of said each of said at least some of the 8x8 pixel blocks;  
7            combining the length of the respective variable-length code for the respective DC  
8    luminance coefficient of said each of said at least some of the 8x8 pixel blocks with the  
9    lengths of the respective variable-length codes for the respective DC  $C_b$  and  $C_r$   
10   chrominance coefficients of said each of said at least some of the 8x8 pixel blocks to  
11   produce a combined code length; and  
12            wherein at least one code length threshold is compared to the combined code  
13   length for producing at least one respective bit indicating whether or not the compressed  
14   video sequence includes an edge associated with said each of said at least some of the  
15   8x8 pixel blocks.

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17            15.    The method as claimed in claim 14, wherein the combined code length is  
18   produced by adding the length of the respective variable-length code for the respective  
19   DC luminance coefficient of said each of said at least some of the 8x8 pixel blocks to the  
20   sum of the lengths of the respective variable-length codes for the respective DC  $C_b$  and  $C_r$   
21   chrominance coefficients of said each of said at least some of the 8x8 pixel blocks.  
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1 the 8x8 pixel blocks and based on the respective bits indicating whether or not the  
2 compressed video sequence includes an edge associated with said at least some of the 8x8  
3 pixel blocks, producing a first series of bits indicating whether or not the compressed  
4 video sequence includes positive horizontal gradient component edges associated with  
5 said at least some of the 8x8 pixel blocks, and producing a second series of bits indicating  
6 whether or not the compressed video sequence includes negative horizontal gradient  
7 component edges associated with said at least some of the 8x8 pixel blocks.

8 The method as claimed in claim 11, which includes inspecting signs of the  
9 respective DC coefficients for said at least some of the 8x8 pixel blocks, and based on the  
10 signs of the respective DC coefficients for said at least some of the 8x8 pixel blocks and  
11 based on prediction directions of the respective DC coefficients for said at least some of  
12 the 8x8 pixel blocks and based on the respective bits indicating whether or not the  
13 compressed video sequence includes an edge associated with said at least some of the 8x8  
14 pixel blocks, producing a first series of bits indicating whether or not the compressed  
15 video sequence includes positive vertical gradient component edges associated with said  
16 at least some of the 8x8 pixel blocks, and producing a second series of bits indicating  
17 whether or not the compressed video sequence includes negative vertical gradient  
18 component edges associated with said at least some of the 8x8 pixel blocks.

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20 20. The method as claimed in claim 12, wherein the DCT coefficients include  
21 respective horizontal frequency DCT coefficients and respective vertical frequency DCT  
22 coefficients for each of the 8x8 pixel blocks, and the method includes inspecting a lowest  
23 nonzero horizontal frequency DCT coefficient and a lowest nonzero vertical frequency

1 DCT coefficient for at least one of the 8x8 pixel blocks to determine orientation of an  
2 edge associated with said at least one of the 8x8 pixel blocks.

3  
4 21. The method as claimed in claim 12, wherein the DCT coefficients include  
5 respective horizontal frequency DCT coefficients and respective vertical frequency DCT  
6 coefficients for each of the 8x8 pixel blocks, and the method includes using a lowest  
7 nonzero horizontal frequency DCT coefficient and a lowest nonzero vertical frequency  
8 DCT coefficient for at least one of the 8x8 pixel blocks for computing an approximate  
9 gradient vector of an edge associated with said at least one of the 8x8 pixel blocks.

10  
11 22. A method of detecting a scene change between I-frames of MPEG video  
12 data, said method comprising:

13 a) detecting edges in images represented by the I-frames by decoding lengths of  
14 variable-length codes for DCT DC coefficients of 8x8 pixel blocks in the I-frames and  
15 performing code length threshold comparisons upon the decoded code lengths to produce  
16 respective edge indications for each of the I-frames; and

17 b) comparing the edge indications between the I-frames in order to signal a scene  
18 change when there is a significant change in the edge indications between the I-frames.

19  
20 23. The method as claimed in claim 22, wherein the detecting of edges in the  
21 images includes producing a frame of bits for at least one of the I-frames, the frame of  
22 bits including at least one respective bit for each of the 8x8 pixel blocks in said at least



1            decoding the length of the respective variable-length code for the respective DC  
2     $C_b$  chrominance coefficient of said each of said at least some of the 8x8 pixel blocks;  
3            decoding the length of the respective variable-length code for the respective DC  
4     $C_r$  chrominance coefficient of said each of said at least some of the 8x8 pixel blocks;  
5            combining the length of the respective variable-length code for the respective DC  
6    luminance coefficient of said each of said at least some of the 8x8 pixel blocks with the  
7    lengths of the respective variable-length codes for the respective DC  $C_b$  and  $C_r$   
8    chrominance coefficients of said each of said at least some of the 8x8 pixel blocks to  
9    produce a combined code length; and  
10           comparing at least one code length threshold to the combined code length for  
11    producing at least one respective bit providing an edge indication for said each of said at  
12    least some of the 8x8 pixel blocks.

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14           27.    The method as claimed in claim 26, wherein the combined code length is  
15    produced by adding the length of the respective variable-length code for the respective  
16    DC luminance coefficient of said each of said at least some of the 8x8 pixel blocks to the  
17    sum of the lengths of the respective variable-length codes for the respective DC  $C_b$  and  $C_r$   
18    chrominance coefficients of said each of said at least some of the 8x8 pixel blocks.

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20           28.    The method as claimed in claim 22, which includes using a thinning filter  
21    for filtering the respective edge indications.

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1           29.    The method as claimed in claim 28, wherein the filtering of the respective  
2 edge indications includes comparing the lengths of the respective variable-length codes  
3 of the DC coefficients for adjacent 8x8 pixel blocks in order to retain indications of edges  
4 associated with 8x8 pixel blocks having longer variable-length codes for their respective  
5 DC coefficients and to exclude indications of edges associated with 8x8 pixel blocks  
6 having shorter variable-length codes for their respective DC coefficients.

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8           30.    The method as claimed in claim 29, wherein an indication of an edge  
9 associated with a block of pixels having a shorter variable-length code of the respective  
10 DC coefficients for a pair of adjacent 8x8 pixel blocks is not excluded upon comparing  
11 signs of the respective DC coefficients for the pair of adjacent 8x8 pixel blocks and  
12 finding that the signs are different.

13  
14           31.    The method as claimed in claim 22, which includes inspecting signs of the  
15 respective DC coefficients for at least some of the 8x8 pixel blocks, and based on the  
16 signs of the respective DC coefficients for said at least some of the 8x8 pixel blocks and  
17 based on prediction directions of the respective DC coefficients for said at least some of  
18 the 8x8 pixel blocks and based on respective bits indicating whether or not an edge is  
19 associated with said at least some of the 8x8 pixel blocks, producing a first series of bits  
20 indicating whether or not positive horizontal gradient component edges are associated  
21 with said at least some of the 8x8 pixel blocks, and producing a second series of bits  
22 indicating whether or not negative horizontal gradient component edges are associated  
23 with said at least some of the 8x8 pixel blocks.

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32. The method as claimed in claim 22, which includes inspecting signs of the respective DC coefficients for at least some of the 8x8 pixel blocks, and based on the signs of the respective DC coefficients for said at least some of the 8x8 pixel blocks and based on prediction directions of the respective DC coefficients for said at least some of the 8x8 pixel blocks and based on respective bits indicating whether or not an edge is associated with said at least some of the 8x8 pixel blocks, producing a first series of bits indicating whether or not positive vertical gradient component edges are associated with said at least some of the 8x8 pixel blocks, and producing a second series of bits indicating whether or not negative vertical gradient component edges are associated with said at least some of the 8x8 pixel blocks.

33. The method as claimed in claim 22, wherein the DCT coefficients include respective horizontal frequency DCT coefficients and respective vertical frequency DCT coefficients for each of the 8x8 pixel blocks, and the method includes inspecting a lowest nonzero horizontal frequency DCT coefficient and a lowest nonzero vertical frequency DCT coefficient for at least one of the 8x8 pixel blocks to determine orientation of an edge associated with said at least one of the 8x8 pixel blocks.

34. The method as claimed in claim 22, wherein the DCT coefficients include respective horizontal frequency DCT coefficients and respective vertical frequency DCT coefficients for each of the 8x8 pixel blocks, and the method includes using a lowest nonzero horizontal frequency DCT coefficient and a lowest nonzero vertical frequency

1 DCT coefficient for at least one of the 8x8 pixel blocks for computing an approximate  
2 gradient vector of an edge associated with said at least one of the 8x8 pixel blocks.

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4 35. A method of detecting a scene change between I-frames of MPEG video  
5 data, each of the I-frames including a series of 8x8 pixel blocks, said method comprising:

6 a) detecting edges in images represented by the I-frames to produce a series of  
7 respective bits indicating whether or not an edge is associated with at least some of the  
8 8x8 pixel blocks;

9 b) filtering the series of the respective bits indicating whether or not an edge is  
10 associated with said at least some of the 8x8 pixel blocks with a thinning filter in order to  
11 produce a filtered series of respective bits including more significant edge indications and  
12 excluding less significant edge indications; and

13 c) operating a digital processor to process the filtered series of respective bits in  
14 order to signal a scene change when there is a significant change in features between the  
15 I-frames.

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17 36. The method as claimed in claim 35, which includes storing a frame of bits  
18 of the filtered series of respective bits for at least one of the I-frames in a frame buffer,  
19 and wherein the digital processor accesses the frame of bits in the frame buffer for  
20 comparing edge indications for an I-frame following said at least one of the I-frames to  
21 edge indications for said at least one of the I-frames.



1           37. The method as claimed in claim 35, wherein the processor extracts  
2 features from the filtered series of respective bits for each of the I-frames and compares  
3 features extracted from at least one of the I-frames to features extracted from an I-frame  
4 following said at least one of the I-frames.

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6           38. The method as claimed in claim 35, wherein the processor computes  
7 characteristics of the filtered series of respective bits for each of the I-frames and  
8 compares the characteristics of the filtered series of respective bits for at least one of the  
9 I-frames to the characteristics of the filtered series of respective bits for an I-frame  
10 following said at least one of the I-frames.

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12           39. The method as claimed in claim 35, wherein the detecting of edges in  
13 images represented by the I-frames includes decoding lengths of variable-length codes of  
14 DCT DC transform coefficients of each of said at least some of the 8x8 pixel blocks and  
15 performing a length threshold comparison upon the decoded lengths of the variable-  
16 length codes to produce the series of respective bits indicating whether or not an edge is  
17 associated with said at least some of the 8x8 pixel blocks.

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19           40. The method as claimed in claim 39, wherein the 8x8 pixel blocks each  
20 have a respective DC luminance coefficient or a respective DC  $C_b$  chrominance  
21 coefficient or a respective DC  $C_r$  chrominance coefficient depending on a color channel  
22 of the 8x8 pixel block, and the method includes:

1            decoding the length of the respective variable-length code for the respective DC  
2    luminance coefficient of said each of said at least some of the 8x8 pixel blocks;  
3            decoding the length of the respective variable-length code for the respective DC  
4     $C_b$  chrominance coefficient of said each of said at least some of the 8x8 pixel blocks;  
5            decoding the length of the respective variable-length code for the respective DC  
6     $C_r$  chrominance coefficient of said each of said at least some of the 8x8 pixel blocks;  
7            combining the length of the respective variable-length code for the respective DC  
8    luminance coefficient of said each of said at least some of the 8x8 pixel blocks with the  
9    lengths of the respective variable-length codes for the respective DC  $C_b$  and  $C_r$   
10   chrominance coefficients of said each of said at least some of the 8x8 pixel blocks to  
11   produce a combined code length; and  
12            comparing at least one code length threshold to the combined code length for  
13   producing at least one respective bit providing an edge indication for said each of said at  
14   least some of the 8x8 pixel blocks.

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16            41.    The method as claimed in claim 40, wherein the combined code length is  
17   produced by adding the length of the respective variable-length code for the respective  
18   DC luminance coefficient of said each of said at least some of the 8x8 pixel blocks to the  
19   sum of the lengths of the respective variable-length codes for the respective DC  $C_b$  and  $C_r$   
20   chrominance coefficients of said each of said at least some of the 8x8 pixel blocks.

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22            42.    The method as claimed in claim 39, wherein the filtering of the series of  
23   the respective bits indicating whether or not an edge is associated with said at least some

1 of the 8x8 pixel blocks includes comparing the decoded lengths of the variable-length  
 2 codes for adjacent 8x8 pixel blocks in order to retain edge indications for 8x8 pixel  
 3 blocks having longer decoded code lengths and to exclude edge indications for 8x8 pixel  
 4 blocks having shorter decoded code lengths.

5  
 6 43. The method as claimed in claim 42, wherein an indication of an edge  
 7 associated with an 8x8 pixel block having a shorter variable-length code of the respective  
 8 DC coefficients for a pair of adjacent 8x8 pixel blocks is not excluded upon comparing  
 9 signs of the respective DC coefficients for the pair of adjacent 8x8 pixel blocks and  
 10 finding that the signs are different.

11  
 12 44. The method as claimed in claim 35, which includes inspecting signs of the  
 13 respective DC coefficients for said at least some of the 8x8 pixel blocks, and based on the  
 14 signs of the respective DC coefficients for said at least some of the 8x8 pixel blocks and  
 15 based on prediction directions of the respective DC coefficients for said at least some of  
 16 the 8x8 pixel blocks and based on the respective bits indicating whether or not an edge is  
 17 associated with said at least some of the 8x8 pixel blocks, producing a first series of bits  
 18 indicating whether or not positive horizontal gradient component edges are associated  
 19 with said at least some of the 8x8 pixel blocks, and producing a second series of bits  
 20 indicating whether or not negative horizontal gradient component edges are associated  
 21 with said at least some of the 8x8 pixel blocks.

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1           45.     The method as claimed in claim 35, which includes inspecting signs of the  
2     respective DC coefficients for said at least some of the 8x8 pixel blocks, and based on the  
3     signs of the respective DC coefficients for said at least some of the 8x8 pixel blocks and  
4     based on prediction directions of the respective DC coefficients for said at least some of  
5     the 8x8 pixel blocks and based on the respective bits indicating whether or not an edge is  
6     associated with said at least some of the 8x8 pixel blocks, producing a first series of bits  
7     indicating whether or not positive vertical gradient component edges are associated with  
8     said at least some of the 8x8 pixel blocks, and producing a second series of bits indicating  
9     whether or not negative vertical gradient component edges are associated with said at  
10    least some of the 8x8 pixel blocks.

11  
12           46.     The method as claimed in claim 35, which includes inspecting a lowest  
13    nonzero horizontal frequency DCT coefficient and a lowest nonzero vertical frequency  
14    DCT coefficient for at least one of the 8x8 pixel blocks to determine orientation of an  
15    edge associated with said at least one of the 8x8 pixel blocks.

16  
17           47.     The method as claimed in claim 35, which includes using a lowest  
18    nonzero horizontal frequency DCT coefficient and a lowest nonzero vertical frequency  
19    DCT coefficient for at least one of the 8x8 pixel blocks for computing an approximate  
20    gradient vector of an edge associated with said at least one of the 8x8 pixel blocks.

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